The AC input **20** is connected to the DC power supply **18**, which includes a full wave rectifier, voltage regulator, and other components form part of the power supply **18** and provide a 5 Volt supply with minimum ripple (5 millivolts maximum ripple). De-coupling capacitors are preferably used between the power and ground pins of the integrated circuit components to limit noise.

Thus, the invention provides an apparatus which utilizes a microphone for continuously monitoring an audio input signal, and by using [speech] speech recognition techniques, identifies the desired human speech commands and controls the current delivered to a lighting fixture including an incandescent lamp or any other suitable load once the appropriate command has been detected.

Turning now to FIG. 3, a typical method of receiving sound data and recognizing voice commands from the sound data for use in the apparatus **10** is illustrated. When the apparatus **10** is in operation, as represented by block **120**, and after it has been trained with voice commands for each user, sound data is constantly monitored at block **122** to determine if a voice command has been uttered. The sound data may contain a combination of voice commands and background noise such as voice conversations, machinery, television, radio, and the like, or any combination thereof. It is not only necessary to separate the voice commands from the background noise in order to issue a control command to a

switching device (such as the dimmer control circuit **16** in FIG. 5), but it is also necessary to properly interpret the voice commands received.

Speech recognition is a process by which one or more unknown speech utterances are identified. speech recognition is generally performed by comparing the features of an unknown utterance with the features of known words. Known words as used herein include, without limitation, words, phrases, phonetic units, and/or phonemic units. The features, or characteristics, of the known words are typically defined through a training process wherein samples of known words are examined and their features are recorded as recognition models in a recognition database. Each recognition model is essentially a reference pattern which represents a single word. Thus, depending on the number of words in a voice command, there will be a corresponding number of recognition models.

The sounds in the data stream are classified and ordered at block **124**, in a well-known manner. The particular features associated with the unknown utterance are often referred to as a "test pattern." The micro-controller **14** compares the test pattern to one or more speech recognition models or templates **128**, **130** and **132**, e.g. the trained voice commands, or combinations thereof, as represented by block **126**. As illustrated, the templates **128**, **130** and **132** might include the voice commands "lightson", "lightsoff", and "dimlights", respectively. A scoring technique is then used at block **134** to provide a relative measure of how

well various recognition model combinations match the test pattern. The unknown utterance is recognized by the known words associated with the recognition model(s) with which the test pattern most closely matches.

As set forth previously, there are many types of speech recognizers, such as, for example, conventional template-based and Hidden Markov Model (HMM) recognizers, as well as recognizers utilizing recognition models based on neural networks. Without loss of generality, the present invention will be illustrated by way of example to the HMM recognizers.

Wordspotter algorithms typically use a recognition network which allows the test pattern to be recognized in terms of a sequence of keyword, filler and silence models. The keyword model refers to voice command words that are to be recognized by the micro-controller **14**, while the filler model refers generally to extraneous background noise that is discarded by the micro-controller. The silence model represents the stationary background noise that occurs before and after keyword utterances. Because of the stationary condition, the silence model is typically modeled with a single looped HMM state in order to detect the beginning and ending of a keyword utterance. In HMM's, a state can be traversed one frame at a time wherein a frame update typically occurs every 10 msec. A formal technique for finding the single best model sequence exists, and is called the Viterbi algorithm (Forney, Jr., G. D., "The Viterbi algorithm", Proc. IEEE,

Vol., 61, pp. 268-278, March, 1978). Rather than calculating the score for every possible model sequence, the Viterbi algorithm reduces the computational load by eliminating all but the best of those partial sequences that merge at a common point, otherwise known as a recombination point.

The keyword detection and false alarm rate for each keyword can be adjusted by adding a score on entering the keyword model, also known as a word entrance penalty. A higher word-entrance penalty results in a lower key word detection and thus results in a lower false alarm rate. This is because the higher cumulative score makes the keyword model less likely to win against the other models at the recombination point. For example, referring to FIG. 3, when a user utters the command "Dim Lights", the cumulative score S_A for "Dim" and "Lights" will most likely be lower when compared to the "DIMLIGHTS" template **132** than the cumulative scores for the other templates **128, 130**.

After the score $_{SA}$ has been generated for the closest matching command template (block **134**), the classified data or "test pattern" is compared at block **136** to an "All Other Sounds" template or filler model **138** which has no defined structure, as in background noise such as voice conversations, machinery, television, radio, and the like, or any combination thereof. A score S_B is then generated at block **140**. The Scores S_A and S_B are then compared at block **142**. If the score S_A is smaller than the score S_B, then the likelihood that the sound data

is a voice command is greater than the likelihood that the sound data is just background noise. Consequently, the system is appropriately triggered at block **144**, depending on the closest matching command template in order to control a lamp or other electrical device. If, however, the score S_A is greater than the score S_B , then the likelihood that the sound data is a voice command is less likely that the sound data is just background noise. Consequently, the apparatus **10** continues to receive sound data at block **122**.

With reference now to FIG. 4, a method of receiving sound data and recognizing voice commands from the sound data for use in the apparatus **10** is illustrated. When the apparatus **10** is in operation, as represented by block **150**, and after it has been trained with voice commands for a user, sound data is constantly monitored at block **152** to determine if a voice command has been uttered. As described above, the sound data may contain a combination of voice commands and background noise such as voice conversations, machinery, television, radio, and the like, or any combination thereof. The sounds in the data stream are then classified and ordered into a test pattern at block **154**, in a well-known manner. The micro-controller **14** compares the test pattern to one or more speech recognition models or templates **158**, **160** and **162**, e.g. the trained voice commands, or combinations thereof, as represented by block **156**.

As illustrated, each of the voice templates **158**, **160** and **162** includes a pause model **164** of predefined duration between keywords in the voice commands. Thus, the command "lightson" in the previous example becomes "lights<pause>on". The command "lightsoff" becomes "lights<pause>off", and the command "dimlights" becomes "dim<pause>lights". The duration of the pause model **164** between each command word may vary depending on the particular speaking style of the user(s), but should be at least one syllable (about 200 msec.) in length. As noted above, the Figure of Merit (FOM) increases with the number of syllables contained in a voice command. For an even greater increase in command detection accuracy, a pause may also be added before and/or after each command word. Thus, instead of a two-syllable command for "lightson", a three-syllable command "lights<pause>on" increases the FOM, while a five-syllable command "<pause>lights<pause>on<pause>" greatly increases the FOM without increasing the number of words in the voice command. This is especially advantageous since the user is not required to memorize long phrases (e.g. five-syllable phrases) for each voice command in order to obtain greater detection accuracy over the prior art.

In order to impose a minimum pause duration of about 200 msec, the pause model **164** needs to contain at least N silence states (represented by s_i in FIG. 4) where

N = minimum pause duration / frame update = 200 msec / 10 msec = 20.

Because each state s_i is modeling the same features as the single silence state, the pause model is created by simply concatenating N silence states. While the minimum duration spent in the pause model is controlled by the number of states, a maximum model duration can be accounted for by adding a pause score whenever a state loops back on itself. The score is called loop transition penalty. Although loop transition penalties cannot completely prevent the best state sequence from remaining longer than a fixed amount of frames in the model, pauses longer than N frames become less likely with duration. Note that each pause model can have a different number of states in order to allow modeling speech pauses of different duration. In particular, pauses at the beginning and end of a voice command do not impede fluency and thus may be chosen to be substantially longer than pauses in between words.

The presence of a pause is preferably determined by analyzing both the spectral content and the energy content of the pause before and/or after the detection of a keyword, depending on the particular sequence of pauses and keywords. If dynamic spectral activity is present at a position in the voice data where the pause should be, such as in the case of voice data, and if the dynamic spectral activity has an energy content that is within a preset energy range of the keyword energy content, then it is determined that no pause has occurred. In the case where the pause has dynamic spectral activity below the preset energy range,

such as in the case of background noise present between keyword utterances, then it is determined that a pause has occurred.

Thus at block **166**, a cumulative score S_A is calculated based on each of the command words and pauses in the voice command to thereby provide a relative measure of how well various recognition model combinations match the test pattern. The unknown utterance must not only have the sound sequence correct, but must also have the unnatural breaks in sound (the pauses) at the correct time in order to create a competitive score for triggering the system.

After the score S_A has been generated for the closest matching command template, the classified data or "test pattern" is compared at block **168** to the "All Other Sounds" template or filler model **138**. A score S_B is then generated at block **170**. The scores S_A and S_B are then compared at block **172**. If the score S_A is smaller than the score S_B, then the likelihood that the sound data is a voice command is greater than the likelihood that the sound data is just background noise. Consequently, the system is appropriately triggered at block **174**, depending on the closest matching command template. If, however the score S_A is greater than the score S_B, then the likelihood that the sound data is a voice command is less than the likelihood that the sound data is just background noise. Consequently, the apparatus **10** continues to receive sound data at block **152**.

Because the invention treats the speech pauses as part of the keywords in the voice commands, a high likelihood score during one or more pauses may compensate the effect of low likelihood scores during the actual words. Thus, some similar sounding utterances may get accepted as keywords primarily due to a good fit during the speech pauses. In order to prevent this from happening, another recognition network may be used in which the contributions from the pause models and the speech models to the overall likelihood score S_A can be uncoupled by making the filler and silence models compete with each pause model and speech model individually. This architecture allows speech utterances to be accepted as valid keywords only if each pause and speech model has been determined to be more likely than any sequence of filler and silence models.

In this recognition network, each individual pause and speech model is assigned a word-entrance penalty whose value is made dependent on the best preceding model as determined by the Viterbi recombination. The word-entrance penalty is assigned a finite value, whenever the best predecessor model (as determined by the Viterbi algorithm) corresponds to the syntactically proper predecessor model (as determined by the structure of the keyword model, e.g. (<pause>speech1<pause>speech2<...). In all other cases, the word-entrance penalty is assigned an infinite value which will inhibit all remaining parts of the keyword model from being further traversed. A keyword is detected as soon as the last model of that keyword survives the recombination step.

The particular values for the finite word-entrance penalties determine the detection and false alarm rate of the corresponding keywords. Because all possible state sequences through the pause models represent a subset of all state sequences through the filler and silence models, the pause models would always lose during recombination. In order to prevent this from happening, the pause models are rewarded upon entry by using negative (rather than positive) word-entrance penalties.

With reference now to Figures 5 to 7, a further embodiment of the invention is illustrated, wherein like elements in the previous embodiment are represented by like numerals. Additional accuracy of voice command detection can be obtained by comparing the energy (E_B) of background noise **180** to the energy (E_C) of a keyword utterance **182** (see Figures 5 and 6). If, after it is determined that S_A is greater than S_B at block 170 in FIG. 7, the signal strength E_C is analyzed at block **190** and the background noise signal strength E_B is analyzed at block **192**. It is then determined if the difference E between the energy E_C of the keyword utterance and the energy E_B of the background noise is above a predetermined value at block **194**, and as shown in FIG. 5. If E is above the predetermined value, then the system is triggered at block **196**. However, if the sound data does not contain enough energy to meet the established energy difference E (see FIG. 6), then the micro-controller assumes that the whole sound data is background

noise and does not trigger the system. Instead of taking the difference between the energies, the ratio or some other means of comparing the energies can be provided.

With the above-described arrangement, the user can enter commands even in loud environments by talking louder than the background. In this way, the keyword<pause>keyword structure can be maintained even if the pause portion is not actually silent. Consequently, the pause portion is only required to have an energy level that is a certain amount lower than the keywords. In many instances, the pause portion will most likely have an energy level equal to the background noise, unless a noise-canceling microphone or the like is used.

Although it is preferred that the signal strength be analyzed and compared after the voice command has met the criteria for both the command words and the pauses, analysis of the voice commands may be triggered only when the difference or ratio between a detected energy level of sound data and background noise is above a predetermined amount.

Turning now to FIG. 8, a modified method of receiving sound data and recognizing voice commands from the sound data according to a further embodiment is illustrated, wherein like parts in the FIG. 3 embodiment are represented by like numerals. In this embodiment, the classified sound data is

compared to the word templates at block **126** and scores are generated for all command word templates at block **200**. It is then determined at block **207** which of all the generated scores is the best, i.e. which template matches most closely with the classified sound data. The speech recognition system has an analysis phase that takes the intrinsic features of a speech signal and extracts some data points from that signal. Those data points are then compared to corresponding data points in the prestored templates. The speech recognition system attempts to determine how likely it is that each one of those data points (in the actual signal) is to the data point that is expected to be seen in the prestored template. Thus, the analysis looks at the incoming data and determines the likelihood of this data correlating with the prestored data. The output is represented as a series of scores or emission probabilities, which represents how close or how well the incoming data and the template data match. As the analyzing portion of the speech recognition system makes its comparison, it determines the likelihood of how well a data point "A" in the incoming data will match with data point "A" in each of the templates, the likelihood of how well data point "B" in the incoming data will match with data point "B" in each of the templates, and so on. Thus, if there are 20 templates in a system, the system will look at the incoming signal and determine its sum probability close to the data points A, B, C, etc., with the corresponding data points in templates 1, 2, 3, ... 20. The template with the greatest sum probability is then chosen as the most likely candidate for the uttered command word. For example, the system will indicate that out of 20 prestored

templates, the incoming data most highly correlates to Template No. 5. The scores for the templates are compared to the scores of the All Other Sounds Template, as represented by block **204**. If the scores of the All Other Sounds Template minus the scores of the most likely template is less than a threshold value S, then the activation system is triggered, as represented by block **144**. If however, the difference between the scores is greater than the threshold value S, then the [speech] speech recognition system determines that the incoming data is not one of the 20 templates. It is not a recognized voice command, and the activation system is not triggered.

According to a unique feature of the invention, the threshold value S can be set by a user through the provision of a threshold adjusting means **206** connected to the micro-controller so that a user can adjust a desired threshold value to thereby effect the outcome of the system. The effect of this is to allow someone who's speech is less compatible with the data represented by templates to use the system with a much higher degree of accuracy or responsiveness by adjusting characteristics that are used to determine whether an uttered word matches the stored data. This is different from speaker adaptive systems used in prior art, wherein the templates were modified based on some user input. In this case, the templates are not adjusted, rather the predetermined threshold used to qualify whether a word is a match is adjusted by the user.

In the invention, preferably, the means for adjusting the threshold value comprises a trim potentiometer that has a digital interface to the speech recognition system. Thus, the setting of the trim potentiometer is sampled or sensed by the speech recognition system. The threshold value S cn be either a discrete step-wise representation of values like integers, such as integers 1, 2, 3, 4, 5, 6, etc. or a continuous relatively fine adjustment, e.g. any value between 0 and 9 rather than the integers. This provides either a fixed step-wise adjustment or continuous adjustment of the threshold value. Although a trim potentiometer is preferred, the threshold adjusting means can take the form of a thumbwheel or sliding potentiometer, a rotary or slide switch with multiple detent switch positions, a DIP switch, an optical encoder, a variably adjustable capacitor, or any other electronic or digital means for adjusting the threshold value.

The threshold adjusting means, no matter what form it takes, sets the point at which the speech recognition system recognizes an uttered command word, i.e. to set the degree of correlation between the incoming data and the template data to thereby trigger the system. This adjusting means allows selective adjustment by a user of the parameters of the similarity measurement, which could either be statistical or rule-based. However, in either case, this would allow a user to adjust a parameter in an embedded system that would normally be fixed. The parameter can have either the effect of adding weight to the output probabilities of the command words or the output probabilities of the All Other Sounds Template.

The effect of the adjustment would be to either change the number of false activations or change the number of positive detections that a [speech] speech recognition system makes. Thus, when a stream of incoming data is compared to the data of the prestored templates, adjusting the threshold value S to a greater value permits a person to utter a command word that is less correlated with the templates in order for the speech recognition system to consider it a match. A sequence is generated that best describes the signal. That sequence of features is then compared to a series of features that stored in the templates. Each data point in the incoming signal is compared to a corresponding area of each stored template and scores are generated to represent how closely the input signal matches each one of the templates. Accordingly, data points that at one point can be rejected because the All Other Sounds Template have created the best score, will now be considered as a match because the All Other Sounds template or the other command word templates were adjusted through the threshold value adjusting means. Although described specifically for use with the Hidden Markov Model, it is to be understood that the threshold adjusting means can be applied to other speech recognition systems.

While the invention has been taught with specific reference to the above-described embodiments those skilled in the art will recognize that changes can be made in form and detail without departing from the spirit and the scope of the

invention. Thus, the described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes that come within the meaning and range of equivalency of the claims are to be embraced within their scope.

CLAIMS

The embodiments for which an exclusive property or privilege is claimed are defined as follows:

1. An apparatus for voice activated control of an electrical device, the apparatus comprising:

receiving means for receiving at least one audio command generated by a user, the at least one audio command having a command word portion and a pause portion, each of the audio command portions being at least one syllable in length;

voice recognition data having a command word portion and a pause portion, each of the voice recognition data portions being at least one syllable in length;

voice recognition means including a Hidden Markov Model for comparing said command word portion and said pause portion of said at least one received audio command with said command word portion and said pause portion, respectively, of said voice recognition data, said voice recognition means generating at least one control signal based on said comparison; and

power control means for controlling power delivered to an electrical device, said power control means being responsive to said at least one control

signal generated by said voice recognition means for operating the electrical device in response to said at least one audio command generated by the user.

2. The apparatus of claim 1, and further comprising means for analyzing the pause portion of the received audio command for spectral content, and further wherein said voice recognition means prevents operation of the electrical device when the spectral content is dynamic.

3. The apparatus of claim 1, wherein said receiving means receives background noise data in conjunction with said audio command, and further comprising means for generating a command word score and a background noise score based on the comparison of the received audio command to the voice recognition data and the background noise data, respectively, said voice recognition means generating said at least one control signal when said command word score exceeds said background noise score.

4. The apparatus of claim 3, and further comprising:

means for analyzing the command word portion of the received audio command and the background noise data for energy content; and

means for comparing the energy content of the command word portion to the energy content of the background noise data and generating a corresponding energy comparison value;

wherein said voice recognition means prevents the generation of said at least one control signal when said energy comparison value is below a predetermined level.

5. The apparatus of claim 1, wherein said receiving means receives background noise data in conjunction with said audio command, and further comprising:

means for analyzing the command word portion of the receive audio command and the background noise data for energy content; and

means for comparing the energy content of the command word portion to the energy content of the background noise data and generating a corresponding energy comparison value;

wherein said voice recognition means prevents the generation of said at least one control signal when said energy comparison value is below a predetermined level.

6. The apparatus of claim 1, wherein each of said at least one audio command and said voice recognition data comprises at least first and second command word portions separated by said pause portion and further comprising a second pause portion having at least one syllable in duration before said first command word portion and a third pause portion having at least one syllable in duration after said second command word portion.

7. The apparatus of claim 1, wherein the voice recognition means further including a microcontroller with a fixed-point embedded microprocessor, the microprocessor is chosen from the group of 8-bit and 16-bit MCU microprocessors.

8. A method of activating an electrical device through at least one audio command from a user, the method comprising the steps of:

recording voice recognition data having a command word portion and a pause portion, each of the voice-recognition data portions being at least one syllable in length;

receiving at least one audio command from a user, the at least one audio command having a command word portion and a pause portion, each of the audio command portions being at least one syllable in length;

comparing said command word portion and said pause portion of said at least one received audio command with said command word portion and said pause portion, respectively, of said voice recognition data;

generating at least one control signal based on said comparison; and

controlling power delivered to an electrical device in response to said at least one control signal for operating the electrical device in response to said at least one received audio command.

9. The method of claim 8, wherein the step of recording voice recognition data includes recording the voice of a user while the user utters said at least one audio command.

10. The method of claim 8, and further comprising the steps of:

analyzing the pause portion of the received audio command for spectral content; and

preventing operation of the electrical device when the spectral content is dynamic.

11. The method of claim 8, and further comprising the steps of:

receiving background noise data in conjunction with receiving said at least one audio command;

comparing the background noise data to the at least one received audio command;

generating a command word score from the comparison of the received audio command to the voice recognition data;

generating a background noise score based on the comparison of the received audio command to the background noise data; and

generating said at least one control signal when said command word score exceeds said background noise score.

12. The method of claim 11, and further comprising:

ascertaining a first energy content for the command word portion of the received audio command;

ascertaining a second energy content for the received background noise data;

comparing the first and second energy contents and generating an energy comparison value; and

preventing the generation of said at least one control signal when said energy comparison value is below a predetermined level.

13. The method of claim 11, wherein the step of generating a command word score includes assigning a word entrance penalty to the command word portion and the pause portion.

14. The method of claim 13, wherein the word entrance penalty of the pause portion is negative.

15. The method of claim 8, and further comprising:

receiving background noise data in conjunction with receiving said at least one audio command;

ascertaining a first energy content for the command word portion of the received audio command;

ascertaining a second energy content for the received background noise data;

comparing the first and second energy contents and generating a corresponding energy comparison value; and

preventing the generation of said at least one control signal when said energy comparison value is below a predetermined level.

16. The apparatus of claim 8, wherein each of said at least one audio command and said voice recognition data comprises at least first and second command word portions separated by said pause portion.

17. The apparatus of claim 14, and further comprising a second pause portion having at least one syllable in duration before said first command word portion and a third pause portion having at least one syllable in duration after said second command word portion.

18. An apparatus for voice-activated control of an electrical fixture, the apparatus comprising:

receiving means for receiving audio data generated by a user;

voice recognition means for determining if the received audio data is a command word for controlling the electrical fixture, the voice recognition means including a microcontroller with a fixed-point embedded microprocessor, a [speech] voice recognition system operably associated with the microcontroller and including a Hidden Markov Model for comparing data points associated with the received audio data with data points associated with voice recognition data previously stored in the voice recognition means, said voice recognition means generating at least one control signal based on said comparison when said comparison reaches a predetermined threshold value; and

power control means for controlling power delivered to the electrical fixture, said power control means being responsive to said at least one control signal generated by said voice recognition means for operating the electrical fixture in response to said at least one audio command generated by the user.

19. The apparatus of claim 18, wherein the microprocessor is chosen from the group of 8-bit and 16-bit MCU microprocessors.

20. The apparatus of claim 19, wherein the microcontroller further includes an analog to digital (A/D) converter for transforming the received voice data to digital data, a Read Only Memory (ROM) bank, a Static Random Access Memory (SRAM) bank, and general purpose Input-Output (I/O) ports.

21. The apparatus of claim 19, and further comprising a printed circuit board, the receiving means, the microcontroller, and the power control means being mounted on the printed circuit board.

22. The apparatus of claim 18, wherein the electrical fixture is a lighting fixture, and the power control means controls power delivered to said lighting fixture.

23. The apparatus of claim 22, wherein the power control means includes a control circuit for turning on, dimming, and turning off said lighting fixture in response to different audio data uttered by a user.

24. The apparatus of claim 18, and further comprising:

means for adjusting the predetermined threshold value to thereby cause a control signal to be generated by said voice recognition means when the audio data generated by the user varies from the previously stored voice recognition data.

25. An apparatus for voice-activated control of an electrical device, the apparatus comprising:

receiving means for receiving audio data generated by a user;

voice recognition means for determining if the received audio data is a command word for controlling the electrical device, the voice recognition means including a microprocessor for comparing the received audio data with voice recognition data previously stored in the voice recognition means, said voice recognition means generating at least one control signal based on said comparison when said comparison reaches a predetermined threshold value;

power control means for controlling power delivered to the electrical device, said power control means being responsive to said at least one control signal generated by said voice recognition means for operating the electrical device in response to said at least one audio command generated by the user; and

means for adjusting the predetermined threshold value to thereby cause a control signal to be generated by said voice recognition means when the audio data generated by the user varies from the previously stored voice recognition data.

26. The apparatus of claim 25, wherein the microprocessor is chosen from the group of 8-bit and 16-bit embedded MCU microprocessors.

ABSTRACT OF THE DISCLOSURE

A voice activated apparatus consists of a receiving arrangement for receiving an audio command having command word and pause portions. A speech recognition data having command word and pause portions. Speech recognition arrangement generating a control signal based on comparing of the command word portion and the pause portion of the audio command with the command word portion and the pause portion of the speech recognition data. A power control arrangement controls power delivered to an electrical device in response to the control signal generated by the speech recognition arrangement in response to the audio command.

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09/443,957	11/19/1999	IGOR ZLOKARNIK	F9618-A	8002

TITLE OF INVENTION: VOICE-ACTIVATED CONTROL FOR ELECTRICAL DEVICE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$640	$0	$640	10/15/2002

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PH 149

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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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7590 07/15/2002

LAWRENCE G FRIDMAN ESQ
SILBERT & FRIDMAN
66 MOUNT PROSPECT AVE.
CLIFTON, NJ 070131918

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee address above, or being facsimile transmitted to the USPTO, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/443,957	11/19/1999	IGOR ZLOKARNIK	F9618-A	8002

TITLE OF INVENTION: VOICE-ACTIVATED CONTROL FOR ELECTRICAL DEVICE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$640	$0	$640	10/15/2002

EXAMINER	ART UNIT	CLASS-SUBCLASS
NOLAN, DANIEL A	2654	704-256000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the USPTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) ☐ individual ☐ corporation or other private group entity ☐ government

4a. The following fee(s) are enclosed:

☐ Issue Fee

☐ Publication Fee

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):

☐ A check in the amount of the fee(s) is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Commissioner is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

Commissioner for Patents is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.

(Authorized Signature) (Date)

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, Washington, DC 20231.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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7590 07/15/2002

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CLIFTON, NJ 070131918

EXAMINER	
NOLAN, DANIEL A	

ART UNIT	PAPER NUMBER
2654	

DATE MAILED: 07/15/2002

Determination of Patent Term Extension under 35 U.S.C. 154 (b)

(application filed after June 7, 1995 but prior to May 29, 2000)

The patent term extension is 0 days. Any patent to issue from the above identified application will include an indication of the 0 day extension on the front page.

If a continued prosecution application (CPA) was filed in the above-identified application, the filing date that determines patent term extension is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) system. (http://pair.uspto.gov)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
NOLAN, DANIEL A	

ART UNIT	PAPER NUMBER
2654	

DATE MAILED: 07/15/2002

Notice of Fee Increase on October 1, 2002

If a reply to a "Notice of Allowance and Fee(s) Due" is filed in the Office on or after October 1, 2002, then the amount due may be higher than that set forth in the "Notice of Allowance and Fee(s) Due" since there will be an increase in fees effective on October 1, 2002. See Revision of Patent and Trademark Fees for Fiscal Year 2003; Notice of Proposed Rulemaking, 67 Fed. Reg. 30634, 30636 (May 7, 2002). Although a change to the amount of the publication fee is not currently proposed for October 2002, if the issue fee or publication fee is to be paid on or after October 1, 2002, applicant should check the USPTO web site for the current fees before submitting the payment. The USPTO Internet address for the fee schedule is: http://www.uspto.gov/main/howtofees.htm.

If the issue fee paid is the amount shown on the "Notice of Allowance and Fee(s) Due," but not the correct amount in view of the fee increase, a "Notice to Pay Balance of Issue Fee" will be mailed to applicant. In order to avoid processing delays associated with mailing of a "Notice to Pay Balance of Issue Fee," if the response to the Notice of Allowance and Fee(s) due form is to be filed on or after October 1, 2002 (or mailed with a certificate of mailing on or after October 1, 2002), the issue fee paid should be the fee that is required at the time the fee is paid. If the issue fee was previously paid, and the response to the "Notice of Allowance and Fee(s) Due" includes a request to apply a previously-paid issue fee to the issue fee now due, then the difference between the issue fee amount at the time the response is filed and the previously paid issue fee should be paid. See Manual of Patent Examining Procedure, Section 1308.01 (Eighth Edition, August 2001).

Effective October 1, 2002, 37 CFR 1.18 is proposed to be revised to change the patent issue fees as set forth below. As stated above, the final fees may be a different amount, and applicant should check the web site given above when paying the fee.

(a) Issue fee for issuing each original or reissue patent, except a design or plant patent:

By a small entity (Sec. 1.27(a))--$655.00
By other than a small entity--$1,310.00

(b) Issue fee for issuing a design patent:

By a small entity (Sec. 1.27(a))--$235.00
By other than a small entity--$470.00

(c) Issue fee for issuing a plant patent:

By a small entity (Sec. 1.27(a))--$315.00
By other than a small entity--$630.00

Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

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Notice of Allowability	Application No.	Applicant(s)	
	09/443,957	ZLOKARNIK ET AL.	
	Examiner	Art Unit	
	Daniel A. Nolan	2654	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed 11 June 2002*.
2. ☒ The allowed claim(s) is/are *1, 3-9, 11-17 & 27*.
3. ☐ The drawings filed on _____ are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
   (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

8. ☒ CORRECTED DRAWINGS must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No. _____.
   (b) ☒ including changes required by the proposed drawing correction filed *11 June 2002*, which has been approved by the Examiner
   (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the top margin (not the back) of each sheet. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1☐ Notice of References Cited (PTO-892)
2☐ Notice of Informal Patent Application (PTO-152)
3☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
4☐ Interview Summary (PTO-413), Paper No._____ .
5☐ Information Disclosure Statements (PTO-1449), Paper No. _____.
6☐ Examiner's Amendment/Comment
7☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
8☒ Examiner's Statement of Reasons for Allowance
9☐ Other

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DETAILED ACTION

Response to Amendment

1. The response of 11 June 2002 has been entered to the following effect:

- The drawing changes are accepted and the objections withdrawn as satisfied.
- The abstract has been replaced and the objections withdrawn.
- The substitute specification has been reviewed and all objections are withdrawn as having been satisfied.
- Claims 2, 10 and 18-26 have been cancelled and the rejections withdrawn as moot.
- Claims 1, 3-9, 12 & 16-17 were changed as indicated and claim 27 was added, then the claims were examined on the merits.

Response to Arguments

2. Applicant's arguments filed 11 June have been fully considered and found to be fully persuasive.

- The material provided does indeed support that a *pause may be measured in syllables*, and the Examiner stands corrected.
- The relevant objections to both specification and claims therefore are withdrawn.

Allowable Subject Matter

3. Claims 1, 3-7, 8, 10-17 and 27 are allowed.

4. The following is an examiner's statement of reasons for allowance:

- Regarding claims 1 and 8; where the prior art of record is typical in enabling a device on recognition, the feature of speech recognition actively *preventing operation* while the signal processing is ongoing is not anticipated nor was it found in obvious combination in the prior art of record.
- Regarding claims 3 and 11, where prior art can be found that uses the *different scores of words and background* to recognize words in the process of selecting words and excluding background noise. While a case could be made that only recognized words generate control signals, the explicit statement that this difference will directly *generate control signals* was considered to have been neither anticipated nor found in an obvious combination in the prior art of record.
- Regarding claims 5 and 15, the features are understood by the Examiner to be the reciprocal corollary to the recognition-action sequence of claims 3 and 10 and so would be found allowable over the prior art of record for the same reasons provided for those claims.
- With further regard to claims 3-7 and 10-17; the claims depend on claims that were found to be allowable and so would they themselves be allowed as a consequence.

- Regarding claim 27, the requirement for an *audio command to have a 1st & 2nd word with three pauses of one syllable duration* is neither anticipated nor was it found in obvious combination in the prior art of record.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

5. The claims have been renumbered in accordance with 37 CFR 1.126 to reflect the removal of cancelled claims. Corresponding adjustments to references were done.

6. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Daniel A. Nolan at telephone (703) 305-1368 whose normal business hours are Mon, Tue, Thu & Fri, from 7 AM to 5 PM.

If attempts to contact the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha Banks-Harold, can be reached at (703) 305-4379.

The fax phone number for Technology Center 2600 is (703) 872-9314. Label informal and draft communications as "DRAFT" or "PROPOSED", & designate formal communications as "EXPEDITED PROCEDURE".

Formal response to this action may be faxed according to the above instructions, or mailed to:

Box AF
Commissioner of Patents and Trademarks
Washington, D.C. 20231

or hand-delivered to:

Crystal Park 2,
2121 Crystal Drive, Arlington, VA,
Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to Technolocy Center 2600 Customer Service Office at telephone number (703) 306-0377.

Daniel A. Nolan
Examiner
Art Unit 2654

dan

July 13, 2002

Richemond Dorvil
Primary Examiner

File No. F9618-A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re New Application of: **Igor Zlokarnik, et al.**

U.S. Application Serial No. **09/443,957**

Filed: **November 19, 1999**

Group Art Unit: **2654**

Examiner: **Daniel A. Nolan**

For: **Voice-Activated Control For Electrical Device**

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

TRANSMITTAL OF
THE AMENDED FORMAL DRAWINGS

Please find enclosed a complete set of the Formal Drawings, including the amended Figures filed June 11, 2002, which have been approved by the Examiner.

Respectfully submitted,

SILBER & FRIDMAN

October 15, 2002

Lawrence G. Fridman
Registration No. 31,615
Attorney for Applicant

66 Mount Prospect Avenue
Clifton, New Jersey 07013-1918
Telephone (973) 779-2580
Fax (973) 779-4473

TRNSdrawings_618A

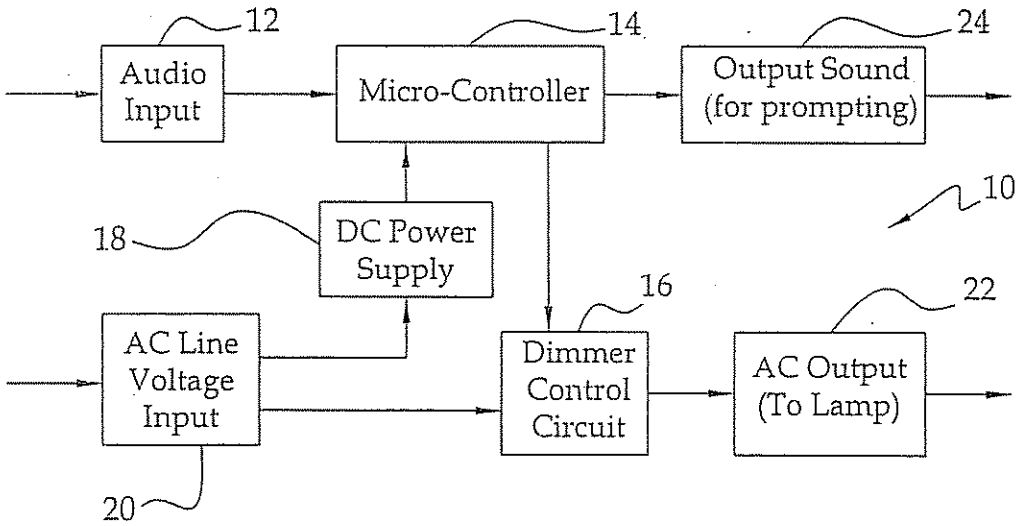

FIG. 1

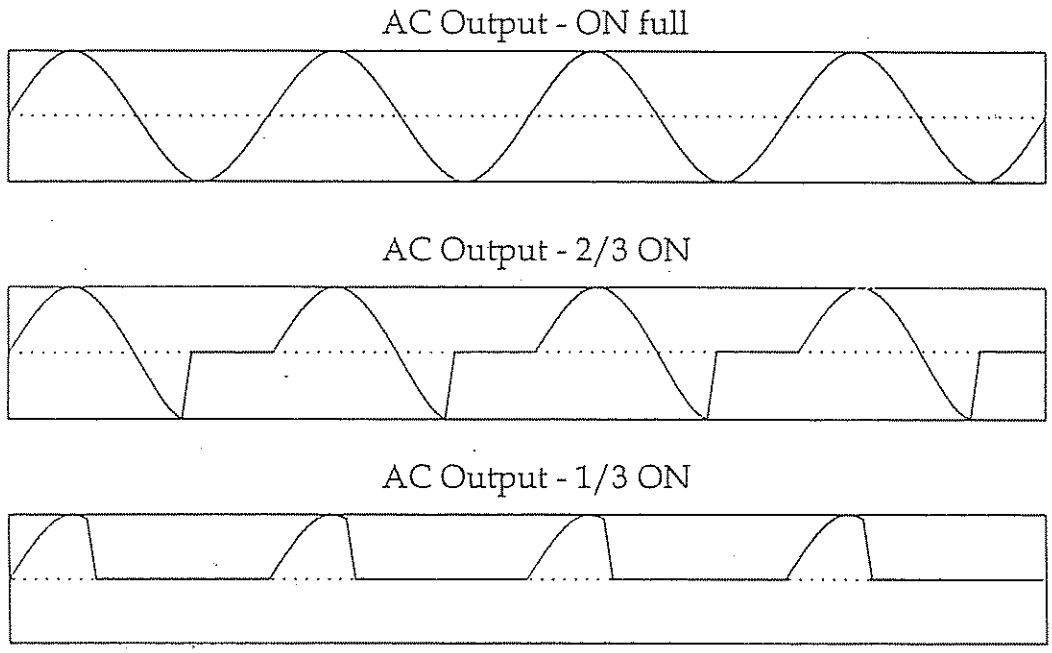

FIG. 2 PRIOR ART

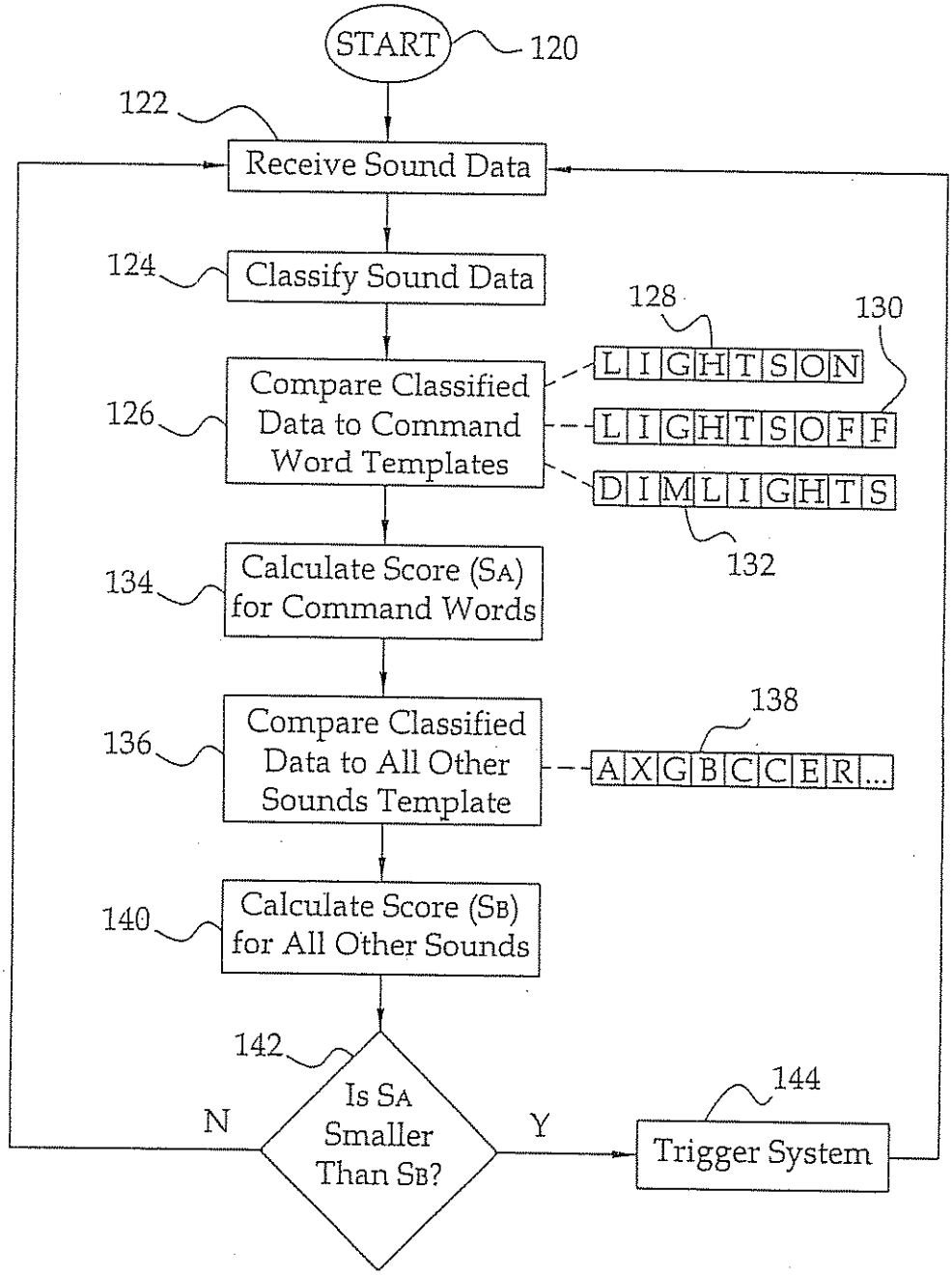

FIG. 3